

What is Claimed is:

1. A process for removing thiophene compounds from liquid fuel, the method comprising the step of:

5 contacting the liquid fuel with an adsorbent which preferentially
adsorbs the thiophene compounds, at a selected temperature and pressure, thereby
producing a non-adsorbed component and a thiophene compound-rich adsorbed
component, wherein the adsorbent comprises an ion-exchanged zeolite selected
from the group consisting of zeolite X, zeolite Y, zeolite LSX, and mixtures
thereof, the zeolite having exchangeable cationic sites, and at least some of the
10 sites having d-block transition metal cation present, and wherein the preferential
adsorption occurs by π -complexation;

 wherein the liquid fuel is at least one of unleaded gasoline and
diesel fuel;

 and wherein, prior to contacting the liquid fuel with the adsorbent,
15 the process comprises pretreating the adsorbent, the pretreatment process
comprising the steps of:

 calcining the adsorbent between about 350°C and about 450°C in
an inert, dry atmosphere for an amount of time ranging between about zero hours
and about 20 hours; and then

20 cooling the adsorbent in a dry atmosphere.

2. The process as defined in claim 1 wherein the amount of
calcining time ranges between about 5 hours and about 15 hours.

25 3. The process as defined in claim 1 wherein the amount of
calcining time is about 10 hours.

 4. The process as defined in claim 1 wherein the selected
temperature and pressure is ambient temperature and ambient pressure.

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5. The process as defined in claim 1, further comprising the step of adding a guard bed adjacent an inlet to the adsorbent such that the liquid fuel contacts the guard bed prior to contacting the adsorbent.

5 6. The process as defined in claim 5 wherein the guard bed has as a main component thereof at least one of activated carbon, activated alumina, silica gel, zeolites, clays, pillared clays, diatomaceous earth, porous sorbents, and mixtures thereof.

10 7. The process as defined in claim 1 wherein the thiophene compounds include at least one of thiophene, methyl-thiophene, benzothiophene, methyl-benzothiophene, dibenzothiophene, 4-methyl-dibenzothiophene, 4,6-dimethyl-dibenzothiophene, 3,6-dimethyl-dibenzothiophene, and mixtures thereof.

15 8. The process as defined in claim 1 wherein at 10^{-5} atm, the adsorbent adsorbs more than about 1 mmol/gram of thiophene.

 9. A process for removing thiophene compounds from liquid fuel, the method comprising the steps of:

20 contacting the liquid fuel with an adsorbent which preferentially adsorbs the thiophene compounds, at a selected temperature and pressure, thereby producing a non-adsorbed component and a thiophene compound-rich adsorbed component; the adsorbent comprising a carrier having a surface area, the carrier having a monolayer of a d-block transition metal compound dispersed on
25 substantially the entire surface area, the metal compound releasably retaining the thiophene compounds; and the carrier comprising a plurality of pores having a pore size greater than the effective molecular diameter of the thiophene compounds; and

 changing at least one of the pressure and temperature to thereby
30 release the thiophene/thiophene compound-rich component from the adsorbent;
 wherein the liquid fuel is at least one of unleaded gasoline and diesel fuel;

and wherein, prior to contacting the liquid fuel with the adsorbent, the process comprises pretreating the adsorbent, the pretreatment process comprising the steps of:

- 5 calcining the adsorbent between about 350°C and about 450°C in
an inert, dry atmosphere for an amount of time ranging between about 5 hours and
about 15 hours; and then
 cooling the adsorbent in a dry atmosphere.

10 10. The process as defined in claim 9 wherein at 10^{-5} atm, the
adsorbent adsorbs more than about 1 mmol/gram of thiophene.

11. The process as defined in claim 9 wherein the amount of
calcining time is about 10 hours.

15 12. The process as defined in claim 9, further comprising the step
of adding a guard bed adjacent an inlet to the adsorbent such that the liquid fuel
contacts the guard bed prior to contacting the adsorbent.

20 13. The process as defined in claim 12 wherein the guard bed has
as a main component thereof at least one of activated carbon, activated alumina,
silica gel, zeolites, clays, pillared clays, diatomaceous earth, porous sorbents, and
mixtures thereof.

25 14. The process as defined in claim 9 wherein the thiophene
compounds include at least one of thiophene, methyl-thiophene, benzothiophene,
methyl-benzothiophene, dibenzothiophene, 4-methyl-dibenzothiophene, 4,6-
dimethyl-dibenzothiophene, 3,6-dimethyl-dibenzothiophene, and mixtures thereof.